CLAIMS

The following is claimed:

1. A method for determining the presence of biomolecules using a surface-enhanced Raman spectroscopy (SERS) system, comprising:

providing a first target biomolecule, a first target nanoparticle, and a first detector nanoparticle;

forming a first detector complex electrochemically on a conductive substrate, wherein the first detector complex includes the first target biomolecule, the first target nanoparticle, and the first detector nanoparticle, wherein the first detector nanoparticle is disposed on the first target nanoparticle, wherein the first target nanoparticle is disposed on the first target biomolecule, and wherein the first target biomolecule is disposed on the conductive substrate;

directing a laser at the first detector complex, wherein the interaction of the laser with the first detector complex produces a SERS signal specific for the first target biomolecule; and

detecting the SERS signal.

2. The method of claim 1, wherein forming a first detector complex electrochemically, comprises:

forming a first target complex that includes the first target biomolecule and the first target nanoparticle; and

disposing the first target complex onto the first conductive substrate.

3. The method of claim 1, wherein forming a first detector complex electrochemically, comprises:

disposing the first target biomolecule onto the first conductive substrate;

contacting the first target nanoparticle with the first target biomolecule; and

forming a first target complex on the first conductive substrate, wherein the first target complex includes the first target biomolecule and the first target nanoparticle.

4. The method of claim 1, wherein the first target nanoparticle includes a gold nanoparticle.

5. The method of claim 1, wherein the first detector nanoparticle includes a silver nanoparticle.

6. The method of claim 1, wherein forming a first detector complex, comprises:

applying a voltage to the first conductive support.

7. The method of claim 1, wherein forming a first detector complex comprises:

contacting the first conductive substrate to a foreign conductive structure to cause the reduction of the first detector nanoparticles onto the first target nanoparticle.

8. The method of claim 1, wherein a first marker molecule is attached to the first target biomolecule.

9. The method of claim 1, wherein a first marker molecule is attached to the first target nanoparticle.

10. A method for determining the presence of biomolecules using a surface-enhanced Raman spectroscopy (SERS) system, comprising:

providing a first target biomolecule;

providing a first target nanoparticle;

forming a first target complex that includes the first target nanoparticle and the first target biomolecule disposed on a first conductive substrate;

providing a solution of first detector nanoparticles;

causing the first target complex to contact the solution of first detector nanoparticles;

catalyzing the deposition of the first detector nanoparticles on the first target complex;

forming a first detector complex that includes the first detector nanoparticle disposed on the first target complex;

directing a laser at the first detector complex, wherein the interaction of the laser with first detector complex produces a SERS signal specific for the first target biomolecule; and

detecting the SERS signal.

11. The method of claim 10, wherein catalyzing comprises:

applying a voltage to the first conductive support.

12. The method of claim 11, wherein the voltage is applied using a potentiostat.

13. The method of claim 10, wherein catalyzing comprises:

contacting the first conductive substrate to a foreign conductive structure to cause the reduction of the first detector nanoparticles onto the first target nanostructures.

14. The method of claim 10, wherein forming a first target complex comprises:

forming the first target complex prior to being disposed on the first conductive substrate.

15. The method of claim 10, wherein forming a first target complex comprises:

forming the first target complex by contacting the first target nanoparticle with the first target biomolecule that is disposed on the first conductive substrate.

16. A biosensor system for determining the presence of biomolecules, comprising:

a first target complex disposed on a first conductive substrate, wherein the first target complex includes a first target biomolecule and a first target nanoparticle, and wherein the first target nanoparticle is disposed on the first target biomolecule;

a first detector nanoparticle disposed on the first target nanoparticle, wherein the first detector nanoparticle is electrochemically deposited on the first target nanoparticle; and

a SERS system capable of detecting a SERS signal specific for the first target biomolecule.

17. The system of claim 17, wherein the first target nanoparticle includes a gold nanoparticle.

18. The system of claim 17, wherein the first detector nanoparticle includes a silver nanoparticle.

19. The system of claim 17, wherein the SERS system includes a laser system.

20. The system of claim 17, wherein the first target nanoparticle includes a nanoparticle in the size range of about 1 nanometer and about 1000 nanometers.

21. The system of claim 17, wherein the first detector nanoparticle includes a nanoparticle in the size range of about 1 nanometer and about 1000 nanometers.

22. The system of claim 17, further comprising a potentiostat capable of causing the first detector nanoparticle to deposit on the first conductive substrate by applying a voltage between about 100 and about 1500 millivolts (versus silver/silver chloride reference electrode) to the first conductive support.

23. The system of claim 17, further comprising:

a second target complex disposed on the first conductive substrate, wherein the second target complex includes a second target biomolecule and a second target nanoparticle, and wherein the second nanoparticle is disposed on the second biomolecule, and

a second detector nanoparticle disposed on the second target nanoparticle, wherein the second detector nanoparticle is electrochemically deposited on the second target nanoparticle; and

wherein the SERS system is capable of detecting a SERS signal specific for the second target biomolecule.

24. The system of claim 17, wherein the first conductive substrate is in a microfluidic chip.

25. The system of claim 17, wherein the first conductive substrate is on the tip of an optical fiber.